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MITRAL HOMOGRAFT REPLACEMENT OF TRICUSPID VALVE IN CHILDREN

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Tricuspid valve replacement in children is a very uncommon procedure. Valvular replacement is a hard decision because of its hazardous implications. Large percentages of side effects complicate the use of mechanical prostheses and heterografts. Recent publications about the use of atrioventricular valve homografts indicated a promising future and showed the feasibility of this technique in a clinical situation.[1-3] We report 2 cases of total replacement of the tricuspid valve with a cryopreserved mitral homograft in young children with previous cardiac operations.

Clinical summaries.

PATIENT 1. An 11-month-old boy was referred in November 1994 for active infective endocarditis caused by *Staphylococcus aureus*. Echocardiography showed several large spots of vegetation in all the tricuspid leaflets, including the subvalvular region, with severe tricuspid regurgitation. The patient was in hemodynamically unstable condition, and the infection was not controlled by medical therapy. Reconstructive surgery was undertaken by resection of the vegetation, leaflet tissue, and chordal involvement. Repair was performed with autologous pericardial patches and reconstruction of the subvalvular apparatus with polytetrafluoroethylene.* The annuloplasty was performed with the Wooler technique. During the postoperative course, tricuspid valve residual stenosis was treated by balloon valvuloplasty. Fourteen months later, the patient was readmitted with severe heart failure (New York Heart Association [NYHA] class IV). Transthoracic echocardiography (TTE) showed severe tricuspid regurgitation with very important dilatation of the right atrium and ventricle and a lower right ventricular shortening fraction (18%). A mitral homograft was selected for tricuspid replacement. The homograft was obtained from a recipient's heart explanted during a transplant operation. The harvest preparation and cryopreservation were performed according to previously described techniques.[3] Anatomic features of the homograft were as follows: diameter (Carpentier obturator), 30 mm; distance between the papillary muscle apex and the valve anulus, 35 mm. The papillary muscle classification according to the Acar technique was type II.

Surgical technique. After total valvular and subvalvular tissue resection (not including papillary muscles), mitral homografts were inserted, with several obligatory differences determined by using the Acar technique.[3] The feasibility of the orientation as to position of the anterior (septal) leaflet at the level of the septum was not possible because the large and long anteromedial papillary muscle was protruding into the infundibular channel, producing right ventricular outflow tract obstruction. Then the posterior homograft leaflet was orientated to the septal position. Circumferential sutures were performed between the homograft and native tricuspid anulus. The posterior papillary muscle was inserted into a trench fashioned in the muscular interventricular septum. The anteromedial papillary muscle was very long, and a transparietal insertion on the epicardial surface of the apex was necessary. A

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*Gore-Tex subvalvular apparatus, registered trademark of W. L. Gore & Associates, Inc, Flagstaff, Ariz.

pericardial patch was used for covering the muscle. An annuloplasty ring was not used. Intraoperative TTE showed satisfactory functional status with moderate prolapse of the homograft leaflets. The postoperative outcome was uneventful, and complete recovery of the functional status was accomplished. Ten days later, the patient was discharged. After 4 years' follow-up, the patient remains asymptomatic, with sinus rhythm and NYHA class I. TTE showed normal function of the homograft without regurgitation or gradient.

PATIENT 2. A 12-year-old girl had had a Danielson repair for severe Ebstein malformation at 4 years of age and a tricuspid valvuloplasty for severe tricuspid regurgitation 6 years later. She was readmitted in March 1997 with severe heart failure. Because of severe massive tricuspid regurgitation confirmed by TTE, we proposed tricuspid valvular replacement with cryopreserved mitral homograft. A mitral homograft was harvested from a cadaveric donor not suitable for heart transplantation. Anatomic features of the homograft were as follows: diameter (Carpentier obturator), 30 mm; distance between the papillary muscle apex and the valve anulus, 33 mm; papillary muscle classification according to Acar,[3] type II.

Surgical technique. The Danielson repair of the Ebstein anomaly was taken down, and remaining tricuspid tissue was resected. The atrialized right ventricular pouch was longitudinally plicated according to the Carpentier technique. The repaired tricuspid anulus was 28 mm in diameter. The coronary sinus was opened, and its internal surface was used like the tricuspid septal anulus to avoid the conduction tissue. The cryopreserved mitral homograft was inserted in the tricuspid position according to previously published techniques, and it was oriented so that the position of the anterior (septal) leaflet was at the level of the septum.

Papillary muscles were inserted into a trench fashioned in the interventricular septum and side to side on the anterior native papillary muscle. A modified Duran (mitral device) prosthetic ring was inserted. TTE showed very good functional results. The outcome was successful, and the patient was discharged 7 days later without fluid retention and with only diuretic medication. Three years later, she was in NYHA class I, without symptoms and with normal clinical and echocardiographic function of mitral homograft. The anulus measurement on high-resolution x-ray film was 27 mm.

Discussion. The surgical treatment of tricuspid valve endocarditis is controversial. In our experience with the excision-only treatment, 4 of 5 children continue to have severe right ventricular failure and a very handicapped life. The other patient underwent successful heart transplantation. Valve repair is an excellent technique when it is possible; however, in the presence of extensive lesions, valve repair should not be performed. Tricuspid valve replacement remains an uncommon surgical procedure. The use of mechanical prostheses in the tricuspid position is associated with a high mortality and morbidity (eg, high incidence of thrombotic complications and valve dysfunction from tissue ingrowth).[4] The heterograft valves were associated with a lower operative mortality but with a very rapid degeneration and calcification. Use of a mitral homograft is an appealing alternative.

In our short experience we advise initial attachment of the leaflet tissue to the anulus to allow determination of the appropriate site of implantation of the papillary muscle on the ventricular wall.[4]

Because of the anatomy of the homograft and the right ventricle in patient 1, we placed the homograft according to the Pomar technique.[2] Nevertheless, we prefer not to orientate the homograft in this way. The use of an annuloplasty ring with mitral devices offers the advantage of remodeling the shape like that of a mitral orifice. In patient 1, with no rotating homograft, an annuloplasty was not feasible because the septal leaflet position was anterior, and it would be severely affected by the ring.

The transmural fixation of the papillary muscles probably solved the late problems (sudden rupture) of the papillary muscle attachment.[5] The main problem of replacement of atrioventricular valves with homografts is their durability, which probably depends on the continued tissue viability. With this method of valve replacement, part of the subvalvular apparatus is preserved so that its important role in ventricular function is retained. At present, the major indication for homograft replacement of the atrioventricular valves is to replace a destroyed tricuspid valve (mainly in children) where previous conservative techniques had failed. The atrioventricular valve homograft is actually the most resistant valve to severe infection, and in the tricuspid position residual dysfunction is well tolerated.

Conclusions. Homotransplantation of unstented cryopreserved mitral homograft in tricuspid position seems to be a method with high biologic and clinical potentials, with better blood flow characteristics, less thrombogenicity, and more resistance to infection than mechanical or biologic prosthesis. Although a larger and longer experience is mandatory, the use of mitral homograft in tricuspid position may represent a valuable alternative, especially in children.

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